

A highly available and expandable, rack-dense, 2U dual-socket SMP server, for application serving in Web environments



## Product Guide

September 2008

# IBM System x3650

## Product Overview

Outstanding performance, availability and capacity in a 2U rack-dense package

**Suggested uses:** *Medium to large enterprises with demanding applications in data-dense environments.*

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Whether you are a small business or a global industry, your mission-critical applications and data must be protected. From a simple application to the most complex solution, the **dual-socket IBM® System x3650**, incorporating **IBM X-Architecture™** features, is designed to protect your data with high performance, high reliability and high availability. The x3650 supports the latest **quad-** and **dual-core Intel® Xeon™** processors (including **50W low-voltage quad-core** Xeon processors), designed with up to a leading-edge **1333MHz** front-side bus (FSB), **64-bit extensions (EM64T)**, and either **6MB** or **4MB** (dual-core) or **8MB** or **12MB** (quad-core) of L2 cache, to help provide you with the computing power you need to match your business needs and growth. In addition, the x3650 uses industry-standard **fully buffered 667MHz** memory with **Chipkill™ ECC** (Error Checking and Correcting) protection—for high performance and reliability. For even higher levels of availability, the x3650 also offers a choice of optional online hot-spare memory or memory mirroring. **Dual** integrated high-speed **Gigabit Ethernet** controllers with **TOE** (TCP Offload Engine) and **Jumbo Frame** support are standard, as are high-performance adapter slots (**PCI-E x8** and optional **PCI-X/133**).

All models offer impressive scalability, including dual-processor support, up to **48GB** of memory and a variety of high-performance internal hard disk and backup drive configurations: up to **six 3.5-inch Serial-Attach SCSI (SAS) hot-swap** drives with an internal storage capacity of **1.8TB<sup>1</sup>**, or up to **six 3.5-inch Serial ATA (SATA) hot-swap** drives (**6TB**), or **eight 2.5-inch SAS hot-swap** drives (**1.17TB**). Hardware-based **RAID-0/1/10** support is standard. An optional **IBM ServeRAID-8k SAS RAID** controller adds **256MB** of battery-backed cache to the onboard controller to provide **three additional RAID** levels, including **RAID-1E/5/6**. The slim **2U** size of the x3650 helps you maximize your rack investments. Up to **21** of these servers can be installed in a single 42U rack, for a total of up to **42** processors, offering the ideal balance of performance, storage and I/O slots per rack. Optional Advanced Connectivity Technology (**ACT**) interconnect cabling helps reduce cable clutter and cost and minimizes installation time when interconnecting many rack-mounted servers.

Standard in the x3650 is a **Baseboard Management Controller (BMC)** that enables the user to manage and control the server easily—both locally and remotely. This high level of manageability is designed to help keep management costs down and the system up. The drop-down **light path diagnostics** panel enables quick servicing of the system if a problem develops. These advanced features help maximize network availability by increasing uptime, as do **hot-swap/redundant HDDs, power and fans; Active Memory™**; **temperature-controlled fans with Calibrated Vectored Cooling™**; **IPMI 2.0** support, including **highly secure remote power control** and **Serial over LAN**; as well as **text-console redirect over LAN**.

With the inclusion of unique IBM service and support features such as **light path diagnostics, IBM Systems Director, IBM Systems Director Active Energy Manager for x86** (formerly known as PowerExecutive), **IBM ServerGuide™** and support for the optional **Remote Supervisor Adapter II SlimLine**, the x3650 is designed for maximum uptime.

If you need a balance of high-performance dual-socket processing and large internal storage in a rack-dense environment, the x3650 is the ideal system.

<sup>1</sup> TB equals 1,000,000,000,000 bytes when referring to hard disk drive capacity. Accessible capacity may be less.

## Selling Features

## Price/Performance

The x3650 offers numerous features to boost performance and reduce product and operating costs:

- Up to **two quad- or dual-core** Xeon processors with high-end **1333MHz** or **1066MHz** front side bus and **4MB to 12MB** (processor-specific) of integrated Level 2 cache per processor offer superior performance capable of tackling the toughest jobs. **64-bit extensions** provide the flexibility to run 32-bit and 64-bit applications concurrently.
- **Low-voltage processors** draw less power and produce less waste heat than high-voltage processors, thus helping to reduce data center energy costs. Some **dual-core** Xeon processors use only **65W**. This is half the wattage consumed by older 130W processors. The **50W** and **80W quad-core** processors are even more economical, consuming only **12.5W** and **20W** (respectively) per core, vs. 32.5W per core for the 65W dual-core processors.
- Ultra-fast **fully buffered 667MHz PC2-5300 DDR II ECC** memory with **Chipkill** protection provides speed and high availability.
- Four **high-speed PCI-E adapter slots** offer potential investment protection by supporting high-performance adapters, such as 10Gb Ethernet, Fibre Channel and InfiniBand cards, none of which will run in older 33MHz and 66MHz conventional PCI slots.
- Integrated **ServeRAID-8k-I** provides **RAID-0/1/10** support at no extra charge and without consuming a valuable adapter slot. RAID-0 offers improved disk performance via data striping; RAID-1 offers disk mirroring for high availability, and RAID-10 combines the benefits of speed and availability.
- Up to **six 3.5-inch** or **eight 2.5-inch** (depending on the model) **hot-swap SAS** or **six 3.5-inch hot-swap SATA** hard disk drives offer high-performance with high availability. The SAS controller provides full-duplex (2 x 300MBps) SAS data transfers, nearly double that of half-duplex Ultra320 SCSI (1 x 320MBps), or half-duplex SATA transfers (1 x 300MBps). **2.5-inch** drives consume approximately *half the power* of 3.5-inch drives.
- The integrated **dual Gigabit Ethernet** controllers with **IPMI 2.0** support provide high-speed network communications. **Jumbo Frames** offer higher efficiency transfers for large data packets.
- The TCP Offload Engine (**TOE**) feature offers higher performance for TCP/IP traffic, with less overhead on the system processor.
- A **high degree of device integration**, including SAS, RAID, dual Gigabit Ethernet, systems management and video controllers, helps to lower costs and frees up valuable adapter slots.

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## Flexibility

The x3650 has the ability to grow with your application requirements, thanks to:

- A choice of **quad-core** or **dual-core** processors with **1.86 to 3.33GHz** clock rates, **1333MHz** or **1066MHz** FSB, and **50W to 120W** maximum power draw.
- Up to **48GB** of high-speed fully-buffered DDR2 system memory.
- **Four available high-performance PCI-E** adapter slots in all models. Optionally, if desired, the riser card containing two of the PCI-E slots can be exchanged for a riser containing two **PCI-X/133** adapter slots.
- Installing the slotless **ServeRAID-8k** option upgrades the integrated **ServeRAID-8k-I** controller with low-cost battery-backed cache to enable even higher-performance hardware RAID support, and offering **six** RAID levels, including **RAID-1E, 5** and **6**.
- The **seven USB 2.0** ports (six external, one internal) are up to **40X** faster<sup>2</sup> than older **USB 1.1** ports. This provides speedy access to external HDDs (non-arrayed), optical drives, tape drives, and other USB devices. Two ports are on the front of the unit and four are on the back. The internal port supports one tape or GoVault EZ backup drive.
- An **integrated SATA II controller** provides support for SATA-based **internal backup** storage
- A choice of up to **four internal 3.5-inch HDDs and a backup** (internal tape or GoVault) **drive, six 3.5-inch HDDs without a backup drive, or eight internal 2.5-inch HDDs and a backup drive**—depending on the model—offer a variety of storage options. The **3.5-inch** models provide a maximum of **1.8TB** of internal **hot-swap SAS** storage (**1.2TB** with an internal backup drive installed) or **6TB** of internal **hot-swap SATA** storage (**4TB** with internal backup drive). The **2.5-inch** models support up to **1.17TB** of **hot-swap SAS** storage *in addition* to an internal backup drive.
- Alternatively, iSCSI or Fibre Channel-attached storage can be attached using **IBM System Storage™** or **TotalStorage®** servers.

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<sup>2</sup> Data transfer rates may be less than the maximum possible.

## Manageability

Powerful systems management features simplify local and remote management of the x3650:

- The x3650 includes a **Baseboard Management Controller (BMC)** to monitor server availability, perform Predictive Failure Analysis, etc., and trigger IBM Systems Director alerts. The BMC enables service personnel to use sophisticated diagnostic tools, such as light path diagnostics, to resolve problems quickly.
  - Integrated **IPMI 2.0** support alerts IBM Systems Director to anomalous environmental factors, such as voltage and thermal conditions. It also supports **highly secure remote power control** using data encryption.
  - **IBM Systems Director Active Energy Manager for x86**, an IBM-exclusive, is designed to take advantage of new system power management features, by providing power monitoring today, and power capping features later.
  - **Text Console Redirection** support allows the administrator to remotely view x3650 text messages over Serial or LAN.
  - **IBM Systems Director** is included for proactive systems management and works with both the blade's internal BMC and the chassis' management module. IBM Systems Director comes with a portfolio of tools, including *Management Processor Assistant, Rack Manager, RAID Manager, Update Assistant* and *Software Distribution*. In addition, IBM Systems Director offers extended systems management tools for additional server management and increased availability. When a problem is encountered, IBM Systems Director can issue administrator alerts via e-mail, pager, and other methods.
  - An optional **Remote Supervisor Adapter II SlimLine** provides additional systems management capabilities, including *Web-based out-of-band control; virtual floppy and optical drive support; Windows "blue screen" error capture; LDAP and SSL support; and remote redirection of PCI video, text, keyboard and mouse*. It also adds *PFA support for fans*. And it does all this without consuming a valuable adapter slot.
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## Availability and Serviceability

The x3650 provides many features to simplify serviceability and increase system uptime:

- x3650 servers use **fully buffered DDR II DIMMs** with Chipkill protection. Chipkill memory is up to **16X** better than standard ECC memory at correcting memory errors. This can help reduce downtime caused by memory errors. **Fully buffered DIMMs** provide additional availability features, including CRC (cyclic redundancy check) monitoring.
  - The x3650 offers selectable **online hot-spare memory** and **memory mirroring** for redundancy in the event of a noncorrectable memory failure.
  - **Toolless cover removal** provides easy access to upgrades and serviceable parts. Similarly, the **Remote Supervisor Adapter II SlimLine** and the **ServeRAID-8k** controller can be installed and replaced without tools. This means less time (and therefore less money) spent servicing the server. Also, **hot-swap/redundant HDDs, fans and power supplies**, as well as **online hot-spare** and **mirrored** memory, can mean greater system uptime while components are being serviced.
  - The **drop-down light path diagnostics panel** and individual light path LEDs quickly lead the technician to failed (or failing) components. This simplifies servicing, speeds up problem resolution and helps improve network availability.
  - **Integrated RAID-1 disk mirroring** and **RAID-10 striped mirrored arrays** enable the server to keep operating in the event of a failure to any one drive.
  - **IPMI 2.0** supports highly secure remote system power control using data encryption. This allows an administrator to restart a server without having to visit it in person, saving travel time and getting the server back up and running quickly and securely. It also adds new features to those provided by IPMI 1.5, including **VLAN** support, **Serial over LAN**, enhanced authentication and encryption algorithms (**RMCP+**, **SHA-1**, **AES**) and a **firmware firewall**.
  - **Temperature-controlled fans** adjust to compensate for changing thermal characteristics. At the lower speeds they draw less power and suffer less wear. Equally important in a crowded data center, temperature-controlled fans produce less ambient noise in the data center than if they were constantly running at full speed.
  - **IBM Thermal Diagnostics** allows the administrator to evaluate thermal data on the server without taking the hardware offline. This can provide greater server uptime.
  - The **three-year (parts and labor) limited onsite warranty**<sup>3</sup> affords you peace of mind and
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<sup>3</sup> For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

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greater investment protection than a one-year warranty does.

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## Key Features

### High-Performance Xeon Processors

The x3650 supports up to two high-performance Intel Xeon processors, allowing you to upgrade to a second processor as business needs require. The x3650 offers a choice of processor clock rates, FSB speeds and energy-efficiency:

- **120W quad-core** Xeon processor models **X5450, X5460, or X5470** at 3.0, 3.16, 3.33GHz respectively with 64-bit extensions, a **1333MHz** FSB, and **12MB** of L2 processor cache (2 x 6MB).
- **50W quad-core** Xeon processor model **L5420** at 2.5GHz with 64-bit extensions, *ultralow power draw (12.5W per core)*, a **1333MHz** FSB, and **12MB** of L2 processor cache (2 x 6MB). Ultralow power processor **L5430** at **2.66GHz** is supported via CTO.
- **80W quad-core** Xeon processor models **E5405, E5420, E5430, E5440** at 2.0, 2.5, 2.66, 2.8GHz (respectively), with 64-bit extensions, a **1333MHz** FSB, and **12MB** of L2 processor cache (2 x 6MB). Processor **E5410** at **2.33GHz** is supported via CTO.
- **65W dual-core** Xeon processor model **E5205** at 1.86GHz with 64-bit extensions, a 1333MHz FSB, and **6MB** of **shared** L2 processor cache. **80W dual-core** Xeon processor model **X5260** at 3.33GHz with 64-bit extensions, a 1333MHz FSB, and **6MB** of **shared** L2 processor cache is supported via CTO.
- **80W dual-core** Xeon processor model **5160** at 3.0GHz, with 64-bit extensions, *reduced power draw*, a **1333MHz** FSB, and **4MB** of **shared** L2 processor cache.



**Dual-core Xeon** processors contain **two complete processor cores**; **quad-core** processors, similarly, contain **four** cores. Some processors contain one **unified** cache **shared** by all cores, while other processors have **independent** caches (one per core or pair of cores). The shared cache is dynamically allocated between the cores as needed. The multiple cores appear to software as multiple physical processors. The dual-core processors offer considerably higher performance than a same-speed Xeon processor with a single core. Likewise, quad-core processors offer considerably higher performance than a same-speed Xeon processor with dual cores.

Intel **Extended Memory 64 Technology (EM64T)** 64-bit extensions allow the Xeon processor to use large memory addressing when running with a 64-bit operating system. This in turn lets individual software processes directly access more than 4GB of RAM, which was the limit of 32-bit addressing. This can result in much higher performance for certain kinds of programs, such as database management and CAD. Additional registers and instructions (SSE3) can further boost performance for applications written to use them. Contact your software providers to determine their software support for EM64T.

The **1066MHz** FSB (which connects memory to the processor) boasts a peak rate of **8.53GBps**, or up to **one-third** higher throughput at the same processor clock speed than an **800MHz** FSB (**6.4GBps**) used in older systems. The **1333MHz** FSB offers a peak rate of **10.67GBps**, or up to **two-thirds** higher throughput at the same processor clock speed than an **800MHz** FSB. This may result in much higher data transfer rates.

**Intelligent Power Capability** powers individual processor elements on and off as needed, to reduce power draw.

**Execute Disable Bit** functionality can help prevent certain classes of malicious buffer overflow attacks when combined with a supporting operating system.

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### DDR II ECC Fully Buffered Memory with Chipkill Protection

The x3650 supports up to **48GB** of memory in **12** DIMM sockets. Some models include **two 512MB** DIMMs standard, while others ship with **two 1GB** DIMMs. The x3650 uses **PC2-5300 fully-buffered** double data rate II (DDR II) memory (operating at **667MHz**) for faster access, and provides Active Memory features, including advanced **Chipkill** memory protection, for **up to 16X** better error correction than standard ECC memory.



The fully buffered memory in the x3650 provides up to **triple** the memory bandwidth (up to **21.3GBps** in **four** channels of PC2-5300 fully-buffered DIMMs vs. a maximum of 6.4GBps in two channels of unbuffered PC2-3200 memory) and up to **triple** the system memory capacity (**12** DIMMs x **4GB**) of the predecessor x346 server (8 DIMMs x 2GB). By performing reads and writes simultaneously, it eliminates the previous memory read-to-write blocking latency. In addition, it also offers innovative data reliability and security features to help improve data integrity, including enhanced CRC protection, data retry on error detect and buffer registers for improved fault isolation.

For increased availability, the x3650 offers two additional (but mutually exclusive) levels of IBM Active Memory protection: online **memory mirroring**, and **online hot-spare memory**.

*Memory mirroring* works much like disk mirroring. The total memory is divided into two channels.

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Data is written concurrently to both channels. If a DIMM fails in one of the DIMMs in the primary channel, it is instantly disabled and the mirrored (backup) memory in the other channel becomes active (primary) until the failing DIMM is replaced. Mirroring can be accomplished with multiples of *four* DIMMs (one pair per memory channel).

When *online hot-spare memory* is enabled, using single and/or dual-rank DIMMs **one rank** is set aside per branch as online spares in case one of the other ranks fails. *The spare rank must have capacity at least that of the largest active rank.* Up to **40GB** (using 12 *single-rank* 4GB DIMMs) or **44GB** (using 12 *dual-rank* 4GB DIMMs) of memory is available when the hot-spare feature is active. (The lowest-numbered rank of those with the highest capacity in each branch is used for the hot-spares.)

Either of these features requires operating system support.

When multiples of four DIMMs (4/8/12) are installed, the x3650 operates in **four-way interleaved** mode, for higher performance. When only **two** DIMMs are used, the system defaults to **two-way interleaved** mode.

DIMMs must be installed in pairs. Memory is available in kits consisting of *two* **512MB, 1GB, 2GB** or **4GB** DIMMs.

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## High-Performance Adapter Slots

The x3650 provides **four physical x8** ("by 8") **PCI-E (PCI Express)** adapter slots standard. Each is capable of supporting **x1/x4/x8** adapters. **Slot 1** is **full-length/full-height** and **Slot 2** is **half-length/full-height**. *Electrically* they are x8 slots as well (meaning that they operate at full **x8 4GBps** speeds). **Slots 3** and **4** are **low-profile/full-length** slots, wired for **x4** speeds (**2GBps**). This provides the flexibility to use x8 cards in those slots (although running at x4 speeds.) If desired, the riser card containing slots **1** and **2** may optionally be replaced with one that provides **two 64-bit** (1Gbps) **133MHz PCI-X** slots instead, one **full-length/full-height** and one **half-length/full-height**.



**PCI-Express** is a high-performance, low-latency, next-generation serial I/O bus that is rapidly replacing the older parallel PCI and PCI-X buses. A **x8** PCI-E adapter offers approximately *four times* the maximum throughput of a 133MHz PCI-X adapter<sup>4</sup>. (A **x1** adapter offers throughput similar to a **66MHz** PCI-X slot.)

Because the **SAS, ServeRAID-8k** and **8k-I**, dual **Gigabit Ethernet, systems management** and **video** controllers are integrated onto the system board, the four adapter slots are all *available*, which offers you a wide degree of latitude in expansion options.

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## Hot-Swap/Redundant Components

System availability is maximized through the extensive use of hot-swap and redundant components, including:

- **Redundant memory** protection (with **Chipkill protection** plus, **memory mirroring** or **online hot-spare** memory enabled)
  - **Hot-swap, redundant hard disk drives** (with **RAID-0/1/10** protection standard and **RAID-1E/5/6** optional)
  - **Hot-swap, redundant power supplies** (optional)
  - **Hot-swap, redundant cooling fans** (optional)
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## Large HDD Storage Capacity

The x3650 offers a choice of disk storage, supporting up to **six (3.5-inch)** or **eight (2.5-inch)** **hot-swap** high-performance Serial-Attach SCSI (**SAS**) drives, or up to **six (3.5-inch)** **hot-swap** Serial-ATA (**SATA**) drives:

### 3.5-inch SAS

- **15,000 RPMs** — 73.4, **146.8** or **300GB (1.8TB maximum)**

### 2.5-inch SAS

- **10,000 RPMs** — 73.4 or **146.8GB (1.17TB)**
- **15,000 RPMs** — **73.4GB (587.2GB)**

### 3.5-inch SATA

- **7,200 RPMs** — 160, 250, 500, 750GB or **1TB (6.0TB)**

2.5-inch drives not only require less space than 3.5-inch drives, they *weigh less, consume half the power, produce less noise, seek faster, and offer increased reliability.*

(**Note:** The use of the internal backup drive option precludes the use of two drive bays, limiting storage to four 3.5-inch HDDs.)

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<sup>4</sup> Actual throughput will depend on the adapter vendor's implementation.



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The hot-swap SAS drives use the Converged Tray for interchangeability with other IBM System x™ and IBM eServer™ xSeries® systems. If you need more storage space, terabyte capacities are possible with external direct-attach, NAS and SAN solutions.

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## Disk/Tape Controllers

All x3650 models include an integrated eight-port **Adaptec AIC9580W Serial-Attach SCSI (SAS)** controller. This controller supports up to **six** or **eight** (depending on the model) internal SAS LVD (low-voltage differential) drives, plus external storage via the SAS port on the rear of the server.

The integrated **ServeRAID-8k-I** controller offers *hardware RAID-0/1/10* support and **32MB** of fast **PC2-4200 DDR2** cache for those SAS drives. The **ServeRAID-8k** option adds **three** additional RAID levels, including **RAID-1E, 5** and **6**, along with **256MB** of cache memory for higher performance, and battery backup, *without* consuming a valuable adapter slot.

The **SAS** controller provides data transfer speeds of up to **300MB** per second<sup>5</sup> in *each* direction (**full-duplex**) across the SAS bus, for an aggregate speed of **600MBps**, nearly double that of Ultra320 SCSI's **320MBps** (half-duplex) bandwidth. The serial design of the SAS bus allows maximum performance to be maintained as additional drives are added.

Other supported RAID controllers include:

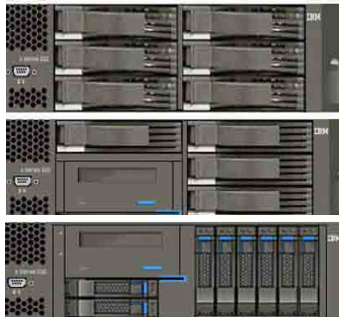
- **ServeRAID-6M** — **Ultra320**, 2-channel, **256MB** battery-backed cache, 133MHz PCI-X (2 ports for external SCSI RAID storage)
- **ServeRAID-6M** — **Ultra320**, 2-channel, **128MB** battery-backed cache, 133MHz PCI-X (2 ports for external SCSI RAID storage)

The **ServeRAID-6M** controllers support external SCSI expansion via the **IBM EXP400** Storage Expansion Unit.

For external storage, the **MegaRAID 8480** controller enables connection to up to **four** IBM System Storage **EXP3000** SAS expansion units (**48** HDDs total). It provides **RAID-0/1/10/5/50** support and **256MB** of onboard cache. Additional external SAS/SATA storage is available using the **external SAS port** on the system unit, or via one of several supported iSCSI or SAN controllers.

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## Drive Bays



The x3650 contains *either seven* or *ten* drive bays in all, depending on the model. Some models offer **six 3.5-inch** bays that support **hot-swap SAS** or **SATA** drives. This enables up to six slimline (1.0") drives totaling up to **1.8TB** (SAS) or **6TB** (SATA) to be installed.

An internal **half-high DDS5** tape drive or **GoVault EZ Drive** can be installed *in place of two* of the HDDs. This offers the confidence of internal tape backup, while still leaving **four** available drive bays (for a total disk capacity of up to **1.2TB** of **SAS** or **4TB** of **SATA** storage, respectively).

Other models feature **eight 2.5-inch** bays that support **hot-swap SAS** drives totaling up to **1.17TB**. In *addition* to the eight 2.5" HDD bays, there is a *dedicated bay* for a **half-high DDS5** tape drive or **GoVault EZ** drive.

A **24X/10X/24X/8X**<sup>6</sup> speed (ultraslim, 0.5") CD-RW/DVD-ROM combo drive with an IDE interface ships standard in all x3650 servers. No floppy drive is supplied with any model; an external USB floppy drive may be used, if needed.

For still more storage, a direct-attach, iSCSI, or FC SAN external expansion option can be added, using an optional controller.

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## Backup Devices

The x3650 supports several internal and external backup options. Supported drives include:

- **36/72 GB DDS-5 Tape Drive** (SCSI)
  - **80/120 GB GoVault EZ Drive** (SATA)
  - **80/160 GB Half High VS160 Tape Drive** (SCSI)
  - **400/800 GB LTO-3 Ultrium Tape Drive** (external SCSI)
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## Dual Gigabit Ethernet Controllers

The x3650 includes **two** integrated **Broadcom BCM5708** Gigabit Ethernet controllers with **TOE** support, as well as **load-balancing** and **failover** capabilities, with up to **10X** higher maximum throughput than a 10/100 Ethernet controller.

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<sup>5</sup> Data transfer rates depend on many factors and are often less than the maximum possible.

<sup>6</sup> Variable read rate. Actual playback speed varies and is often less than the maximum possible.

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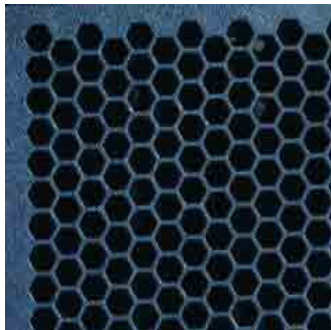
**TOE** helps improve overall system performance by offloading TCP/IP protocol processing from the system microprocessor to the onboard Ethernet TOE processor.

The controllers also support highly secure remote power management using **IPMI 2.0**, plus **Wake on LAN**<sup>®</sup> and **PXE** (Preboot Execution Environment) flash interface. Optional PCI adapters offering failover and load balancing between adapters are available for added throughput and increased system availability.

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## Ultra-Efficient Cooling

Strategically located fans, combined with efficient airflow paths, provide highly effective system cooling for the x3650, known as **Calibrated Vectored Cooling**. The base server with one power supply includes **five fans**. **Five additional hot-swap fans** can be installed along with the redundant power supply.



The system contains **four cooling zones**. **Zone 1** (incorporating one fan in a nonredundant configuration or two with redundancy) cools one processor. **Zone 2** (one or two fans) cools the other processor, **Zone 3** (one or two fans) cools the adapter slots and memory, and **Zone 4** (two or four fans) cools the HDDs, power supplies and system backplane. In addition, each power supply also contains a fan.

The fans automatically adjust speeds in response to changing thermal requirements, from a minimum of **4,250 RPMs** to a maximum of **8,000 RPMs**, depending on the zone, redundancy, and internal temperatures. When the temperature inside the server increases, the fans speed up to maintain the proper ambient temperature. When the temperature returns to a normal operating level, the fans return to their default speed. Why not simply run the fans at 100% capacity all the time? For several good reasons: to reduce the ambient noise, reduce the wear-and-tear on the fans and reduce the server power draw. The reduction in ambient noise and power draw may be relatively minor for a single server, but put dozens or hundreds in a data center and it can make a big difference!

In addition, the server uses **hexagonal ventilation holes** in the chassis. Hexagonal holes can be grouped more densely than round holes, providing greater airflow through the system cover.

This cooling scheme is important because newer, more powerful processors generate a significant amount of heat, and heat must be controlled for the system to function properly.

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## Light Path Diagnostics

Light path diagnostics enables a technician to quickly identify and locate a failed or failing system component, such as a specific fan or memory DIMM. This enables quick replacement of the component, which helps increase server uptime and lower operating costs.



The front of the server has an LED indicator light to show possible component failures. If the front LED indicates an error condition, by pressing a button on the front of the server an LED panel will pop out and drop down for easy viewing without the need to open the server cover or remove the server from the rack. The light path diagnostics panel tells the servicer which component requires attention. In addition, many components have their own identifying LEDs. For example, each of the eight memory modules has an LED next to the socket, as do both processors, all adapter slots, all fans, all power supplies, the voltage regulator module and the service processor, allowing the servicer to easily identify exactly which component needs servicing. By following the "light path," the component can be replaced quickly, and without guesswork. (**Note:** In the event of a failed DIMM, the system will restart and mark the DIMM as bad while offline, thus allowing the system to continue running, with reduced memory capacity, until serviced.)

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## Other Features

- **Seven USB 2.0 ports** — Provides flexibility to add high-speed external devices. The USB 2.0 specification supports up to 480Mbps transfer rates. (Note: Not all USB 2.0 devices are capable of achieving this rate.) Two ports are provided on the front of the server, four are on the back, and one is internal to support a USB-interface tape or GoVault EZ backup drive.
  - **Remote Supervisor Adapter II SlimLine support** — This optional full-function systems management adapter adds local and remote management functions without consuming an adapter slot.
  - **Internal SATA port** — Provides easy connection of **internal SATA-based backup** storage
  - **Dual video ports** — An **ATI Radeon ES1000** SVGA video controller provides up to **1024x768** resolution, with a color depth of **32 bits** at **85Hz** refresh rate. To simplify local systems management, **one** video port is provided on the front of the unit and **one** on the back.
  - **Toolless slides** — Allows quick rack installation and quicker upgrade and servicing of the server.
- 



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- **Toolless chassis** — The cover can be opened without tools, and many components can be removed and replaced without tools, including the CD-RW/DVD combo drive, hot-swap HDDs, plus PCI, PCI-X and PCI-E adapters, as well as the integrated ServeRAID-8k and Remote Supervisor Adapter II SlimLine. This can save a servicer significant time.

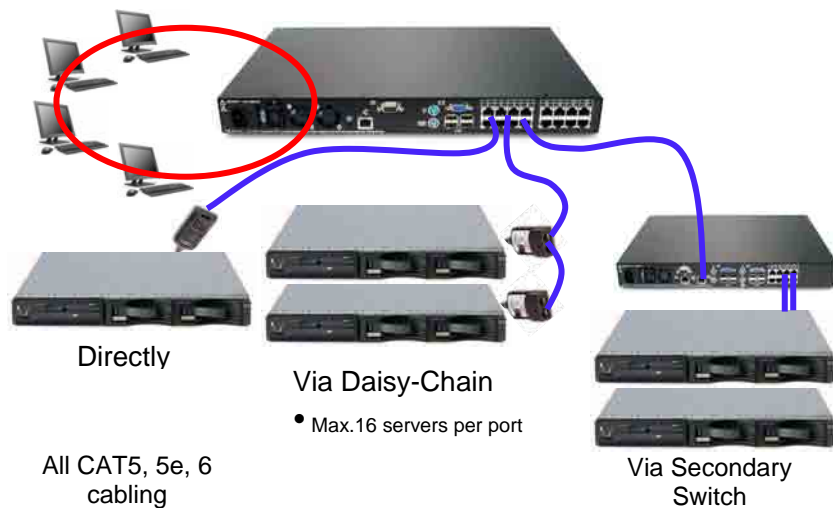
## Rack Cable Management and KVM Console Switching



IBM Advanced Cabling Technology (**ACT**) is an optional feature that offers many advantages over standard KVM cabling across the entire System x and xSeries product line. So now you can interconnect all of your servers with one smart cabling architecture. ACT cabling eliminates the need for one-to-one direct connections between each server and a KVM switch by using a daisy-chain approach.

The snarl of cabling behind most racks is at best inconvenient to work around and at worst an expensive logistical nightmare, requiring the rewiring of servers, PDUs, KVM switches, and other equipment whenever a rack server is added or removed. Even worse, the veil of cables blocks rack airflow and can actually contribute to equipment failure due to overheating. ACT cabling is the solution for reducing behind-the-rack cabling by as much as **87%**.

*The illustration below shows a sample ACT configuration:*



Conventional cabling has bulky KVM cables exiting each server, which then connect to a KVM switch. The cables exiting a series of KVM switches must then be aggregated via additional KVM switches and PDUs, which only increases the number—and cost—of cables, KVM switches and PDUs. Instead, the daisy-chain approach of ACT cabling uses readily available, inexpensive CAT5 and 6 cabling to considerably *reduce* the number of cables, KVM switches, and PDUs needed, rather than increasing them. If a server is removed or added, no complicated rewiring is needed. One cable connects the first server in the rack to the next, and so on. Up to **16** servers form a chain; up to **8** chains can connect to one Local Console Manager (LCM); **16** LCMs can connect to one Global Console Manager (GCM). In this manner, up to **2,048 servers** can be centrally managed. Equally importantly, with ACT—unlike some other offerings—everything is done externally via cabling; *no* special adapters are required.

## Extensive System Support Features

The IBM services and technical support portfolio provides world-class, consistent, high-quality service and support. The x3650 server offers a number of tools and services designed to make ownership a positive experience. From the start, IBM programs make it easier for you to plan for, configure and purchase System x or xSeries servers, get them running and keep them running long-term. These features include IBM Express Portfolio, IBM ServerProven®, the IBM Standalone Solutions Configuration Tool, IBM System x and BladeCenter Power Configurator, IBM ServerGuide, IBM Electronic Service Agent™, Product Customization Services and extensive technical support offerings.



The IBM **ServerProven** program provides the confidence that specific options and operating systems have been tested on the server and are officially supported to work together. It is updated frequently to ensure that the latest compatibility information is always at your fingertips.

The IBM **Standalone Solutions Configuration Tool** (SSCT) is a downloadable tool that simplifies the often complex chore of configuring a full rack of servers (including blade servers) and confirming that you have all the cables, power distribution units, KVM (keyboard, video and



mouse) switch boxes and other components you need, as well as the proper airflow clearances, electrical circuits and other environmental conditions.

**IBM System x and BladeCenter Power Configurator** helps IT managers plan for data center power needs, by providing the following information for specific configurations of System x and BladeCenter systems: *power input* (watts), *PDU sizing* (amps), *heat output* (BTUs), *airflow requirements through chassis* (CFM), *VA rating*, *leakage current* (mA), and *peak inrush current* (amps).

**IBM ServerGuide** (installed from CD) simplifies the process of installing and configuring System x and xSeries servers. ServerGuide goes beyond mere hardware configuration by assisting with the automated installation of the Microsoft® Windows® Server 2000 and 2003 operating systems, device drivers and other system components, with minimal user intervention. (Drivers are also included for support of Novell NetWare, Red Hat Linux and SUSE LINUX.) This focus on deployment helps you reduce both your total cost of ownership and the complexity that administrators and technical personnel face.

**IBM Electronic Service Agent™** is an innovative “call home” feature that allows System x and BladeCenter servers to automatically report hardware problems to IBM support, which can even dispatch onsite service<sup>7</sup> if necessary to those customers entitled to onsite support under the terms of their warranty or an IBM Maintenance Agreement. Electronic Service Agent resides on a server and provides electronic support and problem management capabilities through a highly secure electronic dialogue between your systems and IBM. It monitors networked servers for hardware errors and it can perform hardware and software inventories and report inventory changes to IBM. All information sent to IBM is stored in a highly secure database and used for improved problem determination.

Additional services include hardware warranty upgrades and factory-installed **Product Customization Services** (PCS), such as asset tagging, hardware integration, software imaging and operating systems personalization.

IBM offers extensive **technical support** by phone and via the Web. Support options include links to forums/newsgroups, problem submission, online shopping support, service offerings, device drivers for all IBM product lines, software downloads and even upcoming technical seminar worldwide schedules and registration. Also available are remote installation, configuration and usage support for System x and xSeries hardware and software, as well as onsite custom services to provide the level of expertise you require.

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## **Advanced Systems Management Capabilities**

The x3650 has a high level of systems management capabilities that are well-suited to remote locations as well as to stand-alone environments. Features include the Baseboard Management Controller (BMC), IBM Systems Director Active Energy Manager for x86, Automatic Server Restart, Wake on LAN® support, PXE support, text console redirect, Predictive Failure Analysis, IBM Systems Director and support for an optional Remote Supervisor Adapter II SlimLine.

The BMC provides industry-standard **Intelligent Platform Management Interface (IPMI) 2.0**-compliant systems management. It provides a number of important system functions, including:

- Monitoring of system and battery voltage, system temperature, fans, power supplies, processor and DIMM status
  - Fan speed control
  - Product ID and Family ID detection
  - Highly secure remote power on/off
  - System reset control
  - NMI/SMI detection and generation
  - System diagnostic LED control (power, HDD, activity, alerts, heartbeat)
  - IPMI over LAN
  - Serial Over LAN
  - Proxy server support
  - LAN messaging and alerting
  - Text console redirection over LAN
  - VLAN support
  - Enhanced authentication and encryption algorithms (RMCP+, SHA-1, AES)
  - Local update of BMC firmware
  - Firmware firewall
  - Support for IPMI v2.0 compliant management software (e.g., xCAT)
- 

<sup>7</sup> For onsite labor, IBM will attempt to diagnose and resolve the problem remotely before sending a technician.

- Other mandatory and optional IPMI BMC functions

The BMC alerts IBM Systems Director to anomalous environmental factors, such as voltage and thermal conditions—even if the server has failed.

The x3650 also supports an optional IBM **Remote Supervisor Adapter II SlimLine** for additional systems management capabilities, including:

- Predictive Failure Analysis for system fans
- Graphical console redirection over LAN
- Web-based out-of-band control
- Windows “blue screen” capture
- Remote virtual floppy and CD-ROM
- High-speed remote redirection of PCI video, keyboard and mouse
- SSL (Secure Socket Layer) and LDAP (Lightweight Directory Access Protocol) support

IBM developed IBM **Systems Director Active Energy Manager for x86** to put control of system power-saving features at the fingertips of administrators. *Active Energy Manager* is designed to take advantage of new features, such as monitoring power usage and balancing the performance of the system according to available power input. It provides the ability to plan and predict power consumption based on your hardware configuration. It also helps enable you to reduce the infrastructure required for redundancy, by using fewer servers on smaller power feeds and potentially lowering your overall data center support costs. It does this by inventorying all components, then adding up the total power draw and tracking the usage.

**Automatic Server Restart (ASR)** helps reduce downtime by restarting the server automatically in the event of a system lockup. ASR technology is a combination of hardware circuitry tied into the server’s system reset function and a device driver. As long as the server continues running, the ASR watchdog timer will keep being reset, but if the operating system crashes or the hardware freezes somehow the ASR software will be unable to reset the hardware timer. If the timer is not reset within five minutes, it automatically triggers the ASR hardware, which immediately restarts the server (and logs an ASR event with IBM Systems Director). These features are designed so that *no more than five minutes can pass before the server is restarted*.

**Wake on LAN** permits the server to be remotely powered on if it has been shut off. Once powered up, the server can be controlled across the network, using the **Preboot Execution Environment (PXE)**.

Like Wake on LAN, PXE is system firmware. It enables software such as the optional **IBM Remote Deployment Manager** to take control of a system before the BIOS, operating system or applications are loaded (using Wake on LAN/PXE) and lets an administrator perform many low-level tasks remotely that would otherwise require a visit to each system. These tasks may include such things as formatting a hard disk drive, updating system firmware, or deploying a Windows or Linux operating system.

**Text Console Redirection** support allows the administrator to remotely view x3650 text messages over serial or LAN. An upgrade to the optional **Remote Supervisor Adapter II SlimLine** adds graphical console redirect.

**Predictive Failure Analysis (PFA)** is designed to allow the x3650 to detect impending failure of supported components (processors, memory, voltage regulator modules (VRMs), power supplies and hard disk drives) *before* actual failure, and alert the administrator through IBM Systems Director. This gives you the ability to replace the failing component *before* it fails, resulting in increased uptime.

**IBM Systems Director** software for advanced workgroup management is included with the x3650. IBM Systems Director comes with a portfolio of tools, including *Management Processor Assistant, Rack Manager, RAID Manager, Update Assistant and Software Distribution*. *IBM Systems Director Active Energy Manager for x86, System Availability* (a no-charge download) and *Capacity Manager* (sold separately) are available as add-ons for additional server management and increased availability. IBM Systems Director provides a single uniform graphical interface for all of these systems management functions.

IBM Systems Director enables you to customize thresholds and monitor system components (for things like temperature, voltage regulation, etc.) to help maximize uptime.

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## Key Options

### IBM options for System x servers help you take your servers to a higher level

You can rely on System x options to supply a complete solution for your business needs. Options help you create an optimized server system to meet your data protection, storage and availability needs. Every IBM option is designed and tested for peak performance and flexibility, helping to maximize your return on investment. The combination of System x servers and options lets you keep your fingers on the pulse of your e-business.

**Processors** — The Intel Xeon processor provides high clock rates, dual- or quad-cores, 64-bit extensions, a large cache and advanced features for availability and manageability. Large cache size, combined with a fast **1066MHz** or **1333MHz** front-side bus, reduces memory latency and facilitates the movement of data through the processor and I/O devices. (**Note:** System performance depends not only on the number of processors in the server but also on the power and functionality of each processor.) Adding a second processor may be a cost-effective way to achieve significant performance improvements.

**Memory** — Memory is a significant factor in systems application performance. Adding more memory to a System x server is one of the most effective ways to increase application performance. For best performance in a server with a dual-core processor, there should be twice as much memory available as for a single-core processor. The x3650 takes memory upgrades in pairs and provides either two-way or four-way interleaving (depending on the number of DIMMs installed).

**Hard Disk Drives** — IBM hard disk drives help you improve the transaction and cost performance of your System x servers. The choice of hard disk drives can be a critical aspect of maximizing the I/O throughput of the system. **SAS** hard disk drives are available for the x3650 with capacities up to **300GB** (3.5-inch) apiece at **15,000** RPMs, up to **146.8GB** (2.5-inch) apiece at **10,000** RPMs, or up to **73.4GB** apiece (2.5-inch) at **15,000** RPM. 3.5-inch Serial ATA hard disk drives are available with capacities up to **1TB** apiece at **7,200** RPMs.

**Backup Drives** — IBM backup drives help you protect your data. Several choices of capacities (from **36/72GB** to **400/800GB**), technologies (**removable disk cartridge, DDS5, VS160, LTO3**), and interfaces (**SCSI, SATA, USB**) are available.

**Power Supply** — The optional second power supply for the x3650 enables redundancy for hot-swap power (and adds five additional fans for increased cooling capacity and redundancy).

**Remote Supervisor Adapter II SlimLine** — The x3650 includes a plethora of systems management features built-in; however, sometimes additional management capability is needed. In those situations, the Remote Supervisor Adapter II SlimLine not only offers powerful new features, it does so without taking up a valuable PCI-X or PCI-E adapter slot, instead using a dedicated slot on the motherboard.

**ServeRAID Controllers** — System x servers using embedded ServeRAID-8k technology allow companies to build a reliable foundation for business-critical computing. IBM ServeRAID technology allows an array consisting of multiple physical hard disk drives to be treated as one logical drive. ServeRAID technology also allows data to be stored redundantly, across multiple hard disk drives— enhancing both the integrity and the availability of the data. SAS and SATA ServeRAID controllers offer enhanced performance due to onboard processors and cache. Because IBM ServeRAID controllers can help significantly improve data transfer rates, this technology is extremely effective when implementing demanding, transaction-oriented applications. By employing the advanced fault tolerance of IBM ServeRAID technology, companies can effectively implement networked business systems that require large amounts of storage space for data and applications that must be available for their businesses to continue operating.

The optional integrated **ServeRAID-8k SAS/SATA** controller offers enhanced performance over the integrated ServeRAID-8k-I controller, **256MB** of battery-backed cache memory, and supports **six** RAID levels: **0** (striping), **1** (mirroring), **10** (mirroring and striping), **1E** (enhanced mirroring, supporting odd numbers of drives), **5** (striping with parity), and **6** (striping with double parity).

The family of **ServeRAID-6M (Ultra320)** SCSI controllers offers high performance via an onboard processor and cache, and the ability to add *external* storage capacity for the x3650: up to **8.4TB (28 x 300GB drives)** using a ServeRAID-6M adapter and two IBM **TotalStorage EXP400** Storage Expansion Units, with industry-leading **ServeRAID Manager** (RAID management) software.

The optional **MegaRAID 8480** SAS controller offers high performance and **256MB** of cache memory (with optional battery backup) for *external* SAS storage capacity. The adapter supports **five** RAID levels: **0** (striping), **1** (mirroring), **10** (mirroring and striping), **5** (striping with parity), and **50** (striping/mirroring with parity).

External SAN, NAS and direct-attach storage is available using one of several IBM System

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Storage and TotalStorage host bus adapters.

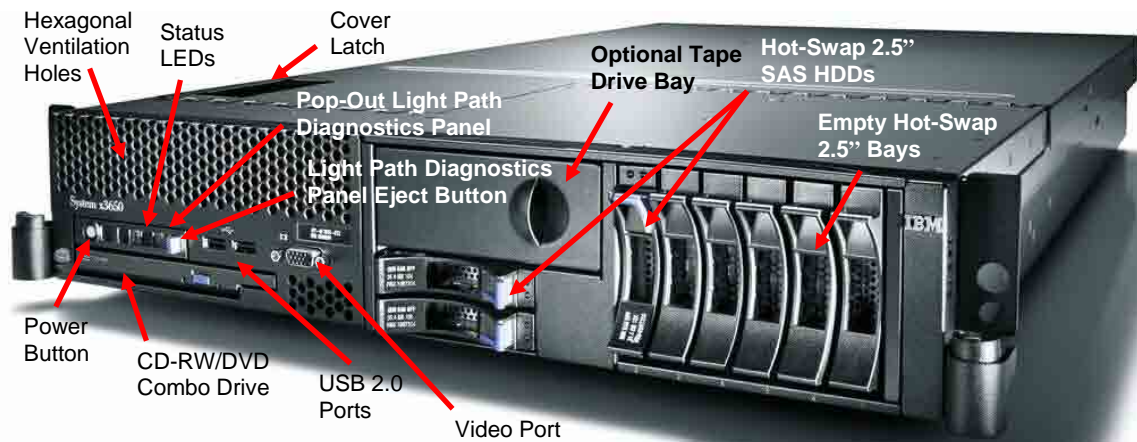
**External Storage** — The IBM **TotalStorage DS3000, DS4000, DS6000, and DS8000** series, as well as the **System Storage DS4000, N3000, N5000, and N7000** series, comprise a powerful and broad shared storage family with integrated management software designed to meet midrange and enterprise needs. For lower-end needs, IBM offers the TotalStorage **DS300** and **DS400** storage enclosures.

Additionally, external LAN-attached tape storage is available.

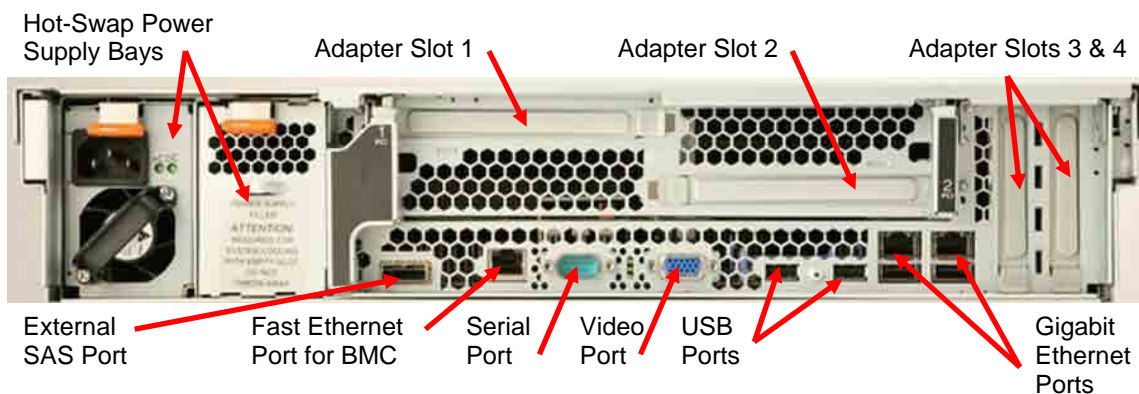
The **iSCSI HBA Adapter for IXA Connectivity** is a PCI adapter for selected System x and xSeries servers that provides a direct **1GBps** link to an IBM System i5 or iSeries server. This connection enables you to centralize your Microsoft Windows and System i5 or iSeries storage and consolidate the operations and backup of your System x, xSeries, System i5 and iSeries systems into a single infrastructure. It enables the tightest possible integration between Windows and System i5/iSeries data and applications, and allows as many as **32** servers to attach to one System i5 or iSeries system to share the iSeries server's systems management, DVD, tape and disk storage via the iSeries dynamic virtual storage architecture. This can take the place of a SAN if you have an established System i5 or iSeries infrastructure.

## **x3650 Images**

### **Front View**

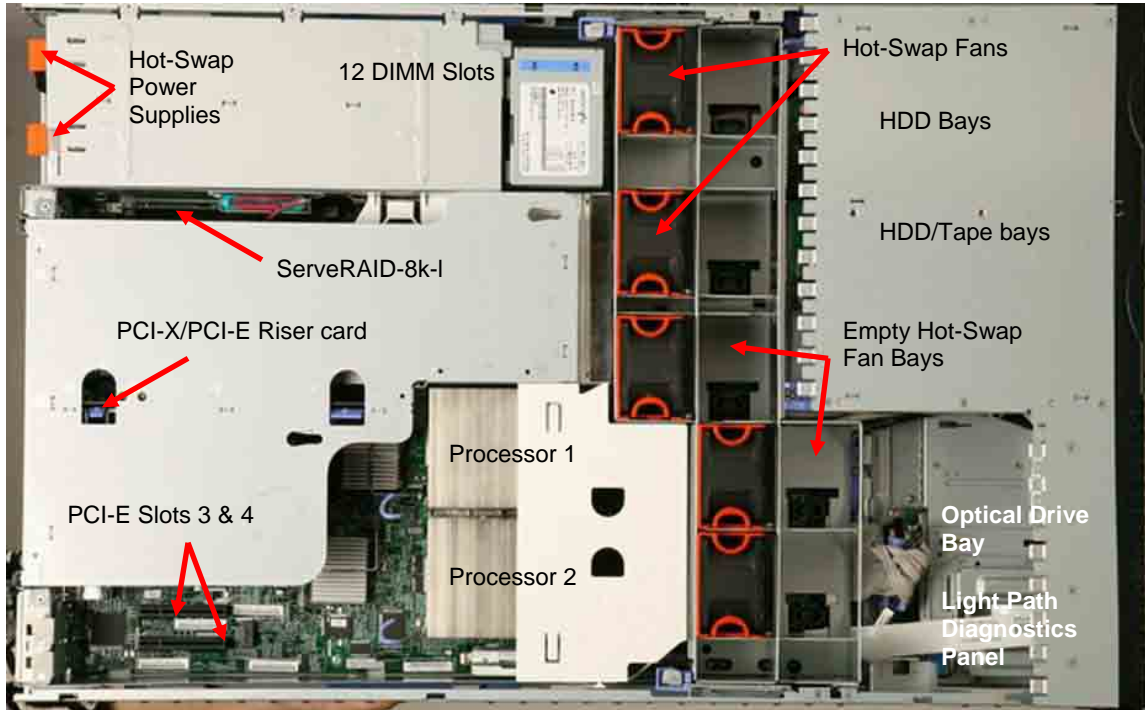


### **Rear View**



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### Interior View



<b>x3650 Specifications</b>				
<b>Machine type</b>	<b>7979-2xX/2xY, 4xX/4xY, 5xX/5xY, 7xX/7xY, BxX/BxY, JxX/JxY, LxX/LxY, MxX/MxY</b>			
<b>Form factor</b>	2U			
<b>Processor type</b>	<b>Quad-core Xeon (E54xx/L54xx/X54xx)</b> <b>2.0GHz</b> E5405 (B1X/B1Y, BAX/BAY), <b>2.5GHz</b> E5420 (B3X/B3Y, BCX/BCY), <b>2.5GHz</b> L5420 (LxX/LxY), <b>2.66GHz</b> E5430 (B4X/B4Y, BDX/BDY), <b>2.8GHz</b> E5450 (B5X/B5Y, BEX/BEY), <b>3.0GHz</b> X5450 (B9X/BJY, BJX/BJY), <b>3.16GHz</b> X5460 (B7X/B7Y, BGX/BGY), <b>3.33GHz</b> X5470 (8Bx/8By, 82x/82y), Also, E5410 ( <b>2.33GHz</b> ) and L5430 ( <b>2.66GHz</b> ) processor via CTO			<b>Dual-core Xeon (E52xx/X52xx)</b> <b>1.86GHz</b> E5205 (MxX/MxY), Also X5260 <b>3.33GHz</b> processor via CTO
				<b>Dual-core Xeon (51xx)</b> <b>1.6GHz</b> E5110 (2xX/2xY), <b>2.0GHz</b> E5130 (4xX/4xY), <b>2.33GHz</b> E5140 (5xX/5xY), <b>3.0GHz</b> E5160 (7xX/7xY)
<b>Maximum processor power draw</b>	<b>50W</b> (JxX/JxY, LxX/LxY)	<b>65W</b> (2xX/2xY, 4xX/4xY, 5xX/5xY, MxX/MxY)	<b>80W</b> (7xX/7xY, B1X/B1Y, B3X/B3Y, B4X/B4Y, B5X/B5Y, BAX/BAY, BCX/BCY, BDX/BDY, BEX/BEY)	<b>120W</b> (B7X/B7Y, BGX/BGY, B9X/B9Y, BJX/BFJY)
<b>Front-side bus (FSB) speed</b>	<b>1333MHz</b> (4xX/4xY, 5xX/5xY, 7xX/7xY, BxX/BxY, LxX/LxY)		<b>1066MHz</b> (2xX/2xY, JxX/JxY, MxX/MxY)	
<b># of processors standard / maximum</b>	1 / 2			
<b>Internal L2 cache</b>	<b>12MB</b> (2 x 6MB shared cache)—BxX/BxY, LxX/LxY	<b>8MB</b> (2 x 4MB shared cache)—JxX/JxY, MxX/MxY	<b>4MB</b> (1 x 4MB shared cache)—2xX/2xY, 4xX/4xY, 5xX/5xY, 7xX/7xY	
<b>Chipset</b>	Intel 5000P			



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<b>x3650 Specifications</b>			
<b>Standard / maximum memory<sup>8</sup></b>	<b>2GB</b> (2 x 1GB) / <b>48GB</b> (BxX/BxY, JxX/JxY, LxX/LxY, MxX/MxY)	<b>1GB</b> (2 x 512MB) / <b>48GB</b> (2xX/2xY, 4xX/4xY, 5xX/5xY, 7xX/7xY)	
<b>Standard memory type</b>	<b>Fully buffered PC2-5300 (667MHz) DDR II ECC with Chipkill protection</b>		
<b>Memory interleaving</b>	Yes (four-way using multiples of 4 DIMMs; two-way otherwise)		
<b>DIMM capacities supported</b>	512MB, 1GB, 2GB, 4GB		
<b># of DIMM sockets total / available</b>	12 / 10		
<b>Online spare memory supported / # of DIMM sockets reserved for sparing</b>	Yes / 1 DIMM "rank" per memory branch (2 ranks total)		
<b>Memory mirroring supported / # of DIMM sockets reserved for mirroring</b>	Yes / 6		
<b># of drive bays total / available</b>	<b>7 / 6</b> (x1X/x1Y, x2X/x2Y, x3X/x3Y, x4X/x4Y, x5X/x5Y, x7X/x7Y, x9X/x9Y)	<b>10 / 9</b> (xAX/xAY, xBX/xBY, xCX/xCY, xDX/xDY)	
<b># of HDD drive bays total / available</b>	<b>6 / 6 3.5-inch</b> (x1X/x1Y, x2X/x2Y, x3X/x3Y, x4X/x4Y, x5X/x5Y, x7X/x7Y, x9X/x9Y)	<b>8 / 8 2.5-inch</b> (xAX/xAY, xBX/xBY, BCX/BCY, xDX/xDY, xEX/xEY, xGX/xGY)	
<b># of 5.25" bays total / available</b>	1 / 0 (CD-RW/DVD installed)		
<b>Maximum HDD capacity</b>	<b>3.5-inch SAS</b> <b>1.8TB</b> (6 x 300GB) <b>hot-swap SAS</b> (without internal backup drive); <b>1.2TB</b> (4 x 300GB) <b>hot-swap SAS</b> with internal backup drive installed (x1X/x1Y, L2X/L2Y, x3X/x3Y, x4X/x4Y, x7X/x7Y, x9X/x9Y)	<b>2.5-inch SAS</b> <b>1.17TB</b> (8 x 146.8GB) <b>hot-swap SAS</b> (with or without internal backup drive) (xAX/xAY, xBX/xBY, xCX/xCY, xDX/xDY, xEX/xEY, xGX/xGY, xJX/xJY)	<b>3.5-inch SATA</b> <b>6.0TB</b> (6 x 1TB) <b>hot-swap SATA</b> (without internal backup drive); <b>4.0TB</b> (4 x 1TB) <b>hot-swap SATA</b> with internal backup drive installed (x1X/x1Y, 22X/22Y)
<b>HDD capacities supported</b>	<b>3.5-inch SAS</b> 73.4, 146.8, <b>300GB</b> — <b>15K</b> RPMs	<b>2.5-inch SAS</b> 73.4, <b>146.8GB</b> — <b>10K</b> RPMs; <b>73.4GB</b> — <b>15K</b> RPMs	<b>3.5-inch SATA</b> 500, <b>750GB</b> — <b>7.2K</b> RPMs
<b># of HDDs standard</b>	None		
<b># of optical drives standard</b>	1 CD-RW/DVD Combo (24X/10X/24X/8X, in dedicated 5.25" UltraBay)		
<b># of diskette drives standard</b>	None (optional)		
<b>Internal backup drives supported</b>	<b>GoVault EZ Drive</b> (USB 2.0 or SATA-attach), <b>DDS-5</b> or <b>VS160 (SCSI)</b> —uses two 3.5" bays		
<b>Disk drive technology</b>	Hot-swap SAS		
<b>Integrated disk controller</b>	Eight-port Adaptec 9580W SAS/SATA		
<b># of disk drives supported per port</b>	1		
<b>External disk drives supported standard</b>	Yes, via external 4-port SAS connector		
<b>Integrated RAID controller / cache</b>	ServeRAID-8k-I ( <b>32MB</b> cache, <b>400MHz DDR2</b> ) standard—internal SAS		
<b>Optional RAID controllers supported</b>	ServeRAID-8k ( <b>256MB</b> , <b>400MHz DDR2</b> )—internal SAS ServeRAID-6M ( <b>128MB</b> or <b>256MB</b> )—external Ultra320 SCSI MegaRAID 8480 ( <b>256MB</b> )—external SAS/SATA		
<b># of adapter slots total / available</b>	4 / 4		
<b># of PCI-E physical x8/electrical x8 slots (4GBps)</b>	2 (standard) <b>One</b> full-height/full-length (Slot 1); <b>one</b> full-height/half-length (Slot 2)		

<sup>8</sup> Maximum memory and disk capacity may require the replacement of standard components with the largest supported component available.

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<b>x3650 Specifications</b>		
<b># of PCI-E physical x8/electrical x4 slots (2GBps)</b>	2 <b>Two</b> low-profile/full-length (Slots 3 & 4)	
<b># of PCI-E x1 slots (500MBps)</b>	None	
<b># of PCI-X/133 slots (1GBps)</b>	None (2 optional, in place of the 2 PCI-E full-height slots)	
<b># of 33MHz legacy PCI slots</b>	None	
<b># of video ports</b>	2 (one front, one rear)	
<b>Video controller</b>	ATI Radeon ES1000	
<b>Video memory</b>	16MB SDRAM	
<b>Maximum video resolution at 32-bit color</b>	1024 x 758 x 32-bit color at 85Hz	
<b>Gigabit Ethernet controller</b>	2 x Broadcom BCM5708	
<b>TOE / failover / load-balancing-capable</b>	Yes / Yes / Yes	
<b># of Gigabit Ethernet ports</b>	2 (rear)	
<b># of RS485 ports</b>	None	
<b># of serial ports</b>	1 (rear)	
<b># of parallel ports</b>	None (USB-attached)	
<b># of mouse ports</b>	None (USB-attached)	
<b># of keyboard ports</b>	None (USB-attached)	
<b># of USB 2.0 ports</b>	<b>6 external</b> (2 front, 4 rear) ports, plus <b>1 internal</b> USB connector	
<b>Integrated systems management controller</b>	Yes (BMC)	
<b>Optional systems management adapter</b>	Remote Supervisor Adapter II SlimLine	
<b>Light path diagnostics support</b>	Yes, with external pop-out/drop-down panel	
<b>Predictive Failure Analysis support</b>	Processors, memory, voltage regulator modules (VRMs), HDDs, power supplies (plus fans, when an optional Remote Supervisor Adapter SlimLine II is used)	
<b>Power supply size</b>	835W universal, autoswitching, hot-swap	
<b># of power supplies standard / maximum</b>	1 / 2	
<b>Hot-swap/redundant power supported</b>	Yes (with two power supplies installed)	
<b># of fans/blowers standard / maximum</b>	5 (with one power supply installed) / 10 (with redundant power installed)	
<b>Hot-swap/redundant fans supported</b>	Yes (with two power supplies installed)	
<b>Heat Emitted: maximum BTUs</b>	3,390	
<b>Rack mount method</b>	Slides and Cable Management Arm (provided standard)	
<b>Maximum altitude</b>	7,000 ft; 2,133 m	
<b>Operating temperature range</b>	50 – 95° F; 10 – 35° C (up to 3,000 ft / 914.4 m)	50 – 90° F; 10 – 32° C (3,000 ft to 7,000 ft / 914.4m to 2,133m)
<b>Dimensions (HWD) / weight</b>	3.36" (85.4mm) <b>H</b> 17.5" (444mm) <b>W</b> 27.5" (698mm) <b>D</b>	<b>65 lb</b> (maximum) <b>29.5 kg</b>
<b>Operating systems supported</b>	Microsoft Windows Server 2003 (Standard/Web/Enterprise Editions) 32/64-bit,	

A highly available and expandable, rack-dense, 2U dual-socket SMP server, for application serving in Web environments

<b>x3650 Specifications</b>	
	Windows 2000 Server (Standard/Enterprise Editions), RHEL 3/4 32/64-bit, SLES 9 32/64-bit, Novell Open Enterprise Server (NetWare 6.5), VMware ESX Server 2.5/3.0
<b>Length of limited warranty</b>	3 years (parts and labor) <sup>9</sup>

### **The Bottom Line**

The x3650 is an extremely powerful system, building on the legacy of the x346 server by incorporating leading-edge industry-standard features and adding IBM-unique innovations:

#### **Price/Performance**

- **High-throughput processors** — 1.6 to 3.16GHz quad-core or 1.6 to 3.0GHz dual-core Xeon processors; up to 8 (quad-core) or 4 (dual-core) processor cores per server
- **Energy-efficient low-voltage processors** — 50W quad-core and 65W dual-core Xeon processors
- **Large cache** — 12MB, 8MB, 6MB or 4MB of L2 processor cache
- **64-bit extensions** (EM64T)
- **Leading-edge front-side bus** — 1333MHz or 1066MHz FSB (model-specific)
- **Fast memory** — Fully buffered 667MHz PC2-5300 DDR II ECC memory standard with two-way or four-way interleaving
- **Fast disk technology** — Integrated Serial-Attach SCSI (SAS) controller and slotless hardware-based RAID-0 data striping and RAID-10 striped/mirrored arrays, with 32MB of onboard cache
- **Fast communications** — Integrated dual Gigabit Ethernet controllers, supporting load-balancing, failover and TOE
- **Fast I/O** — PCI-E x8 adapter slots

#### **Flexibility**

- **Large memory capacity** — 48GB of fully buffered memory, using 12 DIMMs
- A choice of six 3.5-inch SAS or SATA drives or eight 2.5-inch SAS drives
- **High-capacity disk storage** — Up to 1.8TB of internal hot-swap SAS or 6TB of hot-swap SATA storage using 3.5-inch drives; up to 1.17TB of internal hot-swap SAS storage using 2.5-inch drives
- Support for an optional half-height internal backup drive (in place of two 3.5-inch HDDs, or in addition to eight 2.5-inch HDDs); choice of removable disk cartridge (GoVault EZ), DDS-5 tape, or VS160 tape
- **High-performance external expansion** — Seven 480Mbps USB 2.0 ports (two front, four rear, one internal); one external SAS port
- Hardware-based RAID-0/1/10 support standard; optional slotless RAID support for RAID-1E/5/6
- **Four available** adapter slots —
  - Four x8 PCI-E slots (4Gbps)
  - An optional riser card containing two 133MHz PCI-X slots can replace the riser card containing two of the PCI-E slots
- Integrated DVD/CD-RW combo drive
- **Two video ports** (one on the front and one on the back)
- Optional iSCSI HBA Adapter for IXA Connectivity (to System i™/iSeries™ servers)

#### **Manageability, Serviceability and Availability**

- **IBM Systems Director** systems management software, including:
  - IBM Systems Director Active Energy Manager for x86
  - IBM Management Processor Assistant
  - IBM Rack Manager
  - IBM RAID Manager
  - IBM Update Assistant

<sup>9</sup> For terms and conditions or copies of the IBM Statement of Limited Warranty, call 800-772-2227 in the U.S. In Canada call 800-426-2255. IBM makes no representation or warranty regarding third-party products or services including those designated as ServerProven or ClusterProven. Telephone support may be subject to additional charges. For warranties including onsite labor, a technician is sent after IBM attempts to resolve the problem remotely. International warranty service is available in any country in which this product is sold.

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- IBM Software Distribution
  - IBM System Availability
  - **Integrated Baseboard Management Controller (BMC):**
    - IPMI 2.0** compliance, including highly secure remote power control
    - Text console redirection** systems management standard
  - **Active Memory protection:**
    - Advanced **Chipkill** ECC memory protection, and either
    - Online hot-spare** memory, *or*
    - Memory mirroring**
  - Slotless hardware-based **RAID-1** disk mirroring and **RAID-10** striped/mirrored arrays standard; optional slotless **RAID-1E/5/6** highly available arrays
  - **Ultra-efficient cooling** incorporating **Calibrated Vecteded Cooling** features
  - **Hot-swap hard disk drives**
  - Optional **hot-swap/redundant power supplies and cooling**
  - **Light path diagnostics** (front LED panel, drop-down light path panel)
  - Optional **Remote Supervisor Adapter II SlimLine** daughter card (no slot required)
    - Supports **LDAP** and **SSL** industry standards
  - **Toolless chassis** and **toolless slide** design; integrated **Cable Management Arm** simplify installation and removal of the server from the rack
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## For More Information

IBM System x and xSeries Servers  
Electronic Service Agent  
IBM System x and BladeCenter Power Configurator  
Standalone Solutions Configuration Tool  
Configuration and Options Guide  
ServerProven Program  
Technical Support  
Other Technical Support Resources

[ibm.com/systems/x](http://ibm.com/systems/x)  
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MB, GB and TB = 1,000,000, 1,000,000,000 and 1,000,000,000,000 bytes, respectively, when referring to storage capacity. Accessible capacity is less; up to 3GB is used in service partition. Actual storage capacity will vary based upon many factors and may be less than stated.

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will depend on considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

Maximum internal hard disk and memory capacities may require the replacement of any standard hard drives and/or memory and the population of all hard disk bays and memory slots with the largest currently supported drives available. When referring to variable speed CD-ROMs, CD-Rs, CD-RWs and DVDs, actual playback speed will vary and is often less than the maximum possible.

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